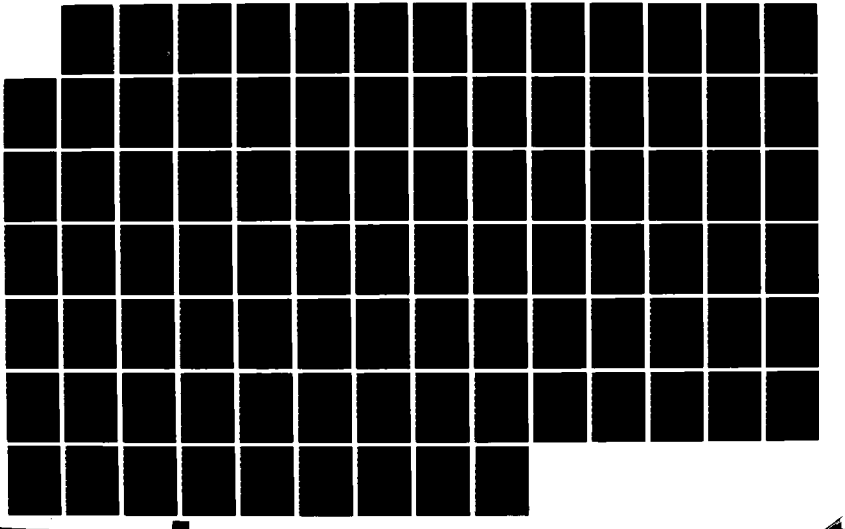
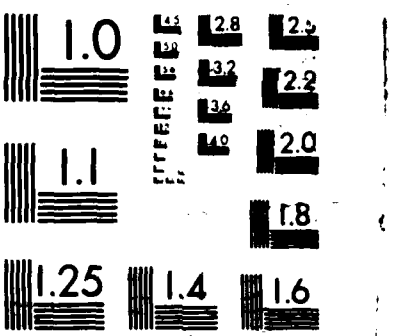
AD-A175 865 HISTORIC PROPERTIES REPORT: PICATINNY ARSENAL DOVER NEW JERSEY(U) DEPARTMENT OF THE INTERIOR WASHINGTON DC P THURBER ET AL. MAR 85 1/1

UNCLASSIFIED F/G 5/6 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.8
3.2
3.6
4.0

HISTORIC PROPERTIES REPORT

PICATINNY ARSENAL

DOVER, NEW JERSEY

FINAL REPORT

MARCH, 1985

This document was prepared by the Historic American Buildings Survey/Historic American Engineering Record of the National Park Service, U.S. Department of the Interior.

EXECUTIVE SUMMARY

Picatinny Arsenal is located in northern New Jersey and has historically served as the center of explosives research, development and production for the U.S. Army since the late 19th century. Presently serving as the headquarters of the U.S. Army Armament Research and Development Command (ARRADCOM), Picatinny Arsenal began as a powder depot in 1880. The Arsenal covers approximately 6,500 acres and has over 1,500 structures, most of which are industrial in design and were constructed during the 1930s and 1940s.

This site has a long history of munitions-related work. During the Revolutionary War an iron forge on this site produced cannon and other iron goods for the Continental forces. Nearly thirty years after it was established as a powder depot Picatinny became a powder factory in 1907, asssuring an important role for itself in World War I. A devastating series of explosions on July 10, 1926 at the adjacent Lake Denmark Naval Powder depot required a great rebuilding effort from which present day Picatinny draws its configuration. The only plant capable of producing large caliber ammunition at the time of the attack on Pearl Harbor, Picatinny Arsenal played a major role in suppling the munitions used during World War II. Since the war the arsenal has continued to perform research during times of peace and production during times of conflict.

Dozens of structures have been identified as significant to the history of Picatinny. Some of these are in use, some on stand-by, and others are scheduled for demolition. A Multiple Resource National Register Nomination has been prepared for several of the important production lines and plans are underway to record much of the important areas to the standards of the Historic American Engineering Record (HAER).

CONTENTS

A-1

PREFACE

This report presents the results of an historic properties survey of Picatinny Arsenal, at Dover, New Jersey. Prepared for the United States Army Materiel Development and Readiness Command (DARCOM), the report is intended to assist the Army in bringing these installations into compliance with the National Historic Preservation Act of 1966 and its amendments, and related federal laws and regulations. To this end, the report focuses on the identification, evaluation, documentation, nomination, and preservation of historic properties at the two installations. Chapter 1 sets forth the survey's scope and methodology; Chapter 2 presents an architectural, historical, and technolgical overview of the installations and their properties; and Chapter 3 identifies significant properties by Army category and sets forth preservation recommendations. Illustrations and an annotated bibliography supplement the text.

This report is part of a program initiated through a memorandum of agreement between the National Park Service, Department of the Interior, and the U.S. Department of the Army. The program covers 74 DARCOM installations and has two components: 1) a survey of historic properties (districts, buildings, structures, and objects), and 2) the development of archeological overviews. Stanley H. Fried, Chief, Real Estate Branch of Headquarters DARCOM, directed the program for the Army, and Dr. Robert J. Kapsch, Chief of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) directed the program for the National Park Service. Sally Kress Tompkins was program manager, and Robie S. Lange was project manager for the historic properties survey.

Picatinny Arsenal was one of five DARCOM installations selected as pilot projects in which HABS/HAER could test its DARCOM project methodology prior to awarding the survey task of the remaining 69 installations to a private contractor.

Eric DeLony of the HABS/HAER Washington office served as Project Leader. The field work and report were completed by a HABS/HAER summer inventory team under Pamela Thurber, Field Supervisor. The team consisted of David Buchanan and Deborah Wolf, Architectural Historians, and David Ashby and John Mecum, Architect Technicians.

Nicholas F. Mergel, Chief of the Environmental Office, and Frances F. Grego, of his staff served as the team's official point of contact and helped coordinate work with numerous other individuals whose assistance was of great value. Some of those individuals who assisted the inventory team include: Robert Aikens, Ronald Bailey, Domenic Bizzari, Robert Cruthers, Patrick Cunningham, Richard Drew, Ray Hajducsek, William Huffman, Alvis Lewis, Clifford Love, Luther Martin, John McDonough, Manny Meyers, Clare Nugent, Clifford Redden, Louis Rigassio, Donald Snyder, William Sweeney, Frank J. Van Fleet and Samuel Zarra.

The complete HAER documentation for this installation will be included in the HABS/HAER collection at the Library of Congress, Prints and Photographs Division, under the designation HAER # NJ-36.

Chapter 1

INTRODUCTION

SCOPE

This report is based on an historic properties survey conducted in 1982 of all Army-owned properties located within the official boundaries of Picatinny Arsenal. The survey included the following tasks:

Completion of documentary research on the history of the installation and its properties.

Completion of a field inventory of all properties at the installation.

Preparation of a combined architectural, historical, and technological overview for the installation.

Evaluation of historic properties and development of recommendations for preservation of these properties.

Also completed as a part of the historic properties survey of the installation, but not included in this report, are HABS/HAER Inventory cards for approximately 800 individual properties. These cards, which con titute HABS/HAER Documentation Level IV, will be provided to the Department of the Army.

Archival copies of the cards, with their accompanying photographic negatives, will be transmitted to the HABS/HAER collections at the Library of Congress. A Multiple Resource National Register Nomination was developed for the Original Picatinny Arsenal Area and the 200, 400, 500, 600, and 800 Production Areas.

The methodology used to complete these tasks is describe in the following section of this report.

METHODOLOGY

1. Documentary Research

Picatinny Arsenal is involved with munitions and its history is largely tied to the research, development and production of explosives. Documentary research relied upon our understanding of the production areas which was gained through the assistance of personnel of the Technical Services Division who provided explanation of the workings of these areas. A literature search of historical and technical data was undertaken at the base library, the installation historian's office, and tne Library of Congress and National Archives in Washington, D.C.

Army records used for the field inventory included current Real Property Inventory (RPI) printouts that listed all officially recorded buildings and structures by facility classification and date of construction; the installations' property record cards; base maps and photographs; and installation master planning, archeological, and environmental assessment and related reports and documents. A complete listing of documentary material may be found in the bibliography.

2. Field Inventory

The field inventory was conducted during the summer of 1982 by Pamela Thruber, David Buchanan, Deborah Wolf, David Ashby and John Mecum. Field inventory procedures were based on the HABS/HAER Guidelines for Inventories

of Historic Buildings and Engineering and Industrial Structures.[1] HABS/HAER Inventory forms were prepared for, and black and white 35 mm photographs taken of, all buildings and structures through 1945 except basic utilitarian structures of no architectural, historical, or technological interest. When groups of similar ("prototypical") buildings were found, one field form was normally prepared to represent all buildings of that type. Field inventory forms were also completed for representative post-1945 buildings and structures.[2] Information collected on the field forms was later evaluated, condensed, and transferred to HABS/HAER Inventory cards.

3. Historic Overview

A combined architectural, historical, and technological overview was prepared from information developed from the documentary research and the field inventory. It was written in two parts: 1) an introductory description of the installation, and 2) a history of the installation by periods of development, beginning with pre-military land uses.

The objectives of the overview were to 1) establish the periods of major construction at the installation, 2) identify important events and individuals associated with specific historic properties, 3) describe patterns and locations of historic property types, and 4) analyze specific building and industrial technologies employed at the installation.

4. Property Evaluation and Preservation Measures

Based on information developed in the historic overviews, properties were first evaluated for historic significance in accordance with the eligibility criteria for nomination to the National Register of Historic Places. These criteria require that eligible properties possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that they meet one or more of the following:[3]

A. Are associated with events that have made a significant contribution to the broad patterns of our history;

B. Are associated with the lives of persons significant in the nation's past;

C. Embody the distinctive characteristics of a type, period or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction;

D. Have yielded, or may be likely to yield, information important in pre-history or history.

Properties thus evaluated were further assessed for placement in one of five Army historic property categories as described in Army Regulation 420-40:[4]

Category I	Properties of major importance
Category II	Properties of importance
Category III	Properties of minor importance
Category IV	Properties of little or no importance at this time
Category V	Properties detrimental to the significance of adjacent historic properties

Based on an extensive review of the architectural, historical, and technological resources identified on DARCOM installations nationwide, four criteria were developed to help determine the appropriate categorization level for each Army property. These criteria were used to assess the importance not only of properties of traditional historical interest, but of the vast number of standardized or prototypical buildings, structures, and production processes that were built and put into service during World War II, as well as of properties associated with many post-war technological achievements. The four criteria were often used in combination and are as follows:

1) Degree of importance as a work of architectural, engineering or industrial design. This criterion took into account the qualitative factors by which design is normally judged: artistic merit, workmanship, appropriate use of materials, and functionality.

2) Degree of rarity as a remaining example of a once widely used architectural, engineering, or industrial design or process. This criterion was applied primarily to the many standardized or prototypical DARCOM buildings, structures, or industrial processes. The more widespread or influential the design or process, the greater the importance of the remaining examples of the design or process was considered to be. This criterion was also used for non-military structures such as farmhouses and other once prevalent building types.

3) Degree of integrity or completeness. This criterion compared the current condition, appearance, and function of a building, structure, architectural assemblage, or industrial process to its original or most historically important condition, appearance, and function. Those properties that were highly intact were generally considered of greater importance than those that were not.

4) Degree of association with an important person, program, or event. This criterion was used to examine the relationship of a property to a famous personage, wartime project, or similar factor that lent the property special importance.

The majority of DARCOM properties were built just prior to or during World War II, and special attention was given to their evaluation. Those that still remain do not often possess individual importance, but collectively they represent the remnants of a vast construction undertaking whose

architectural, historical, and technological importance needed to be assessed before their numbers diminished further. This assessment centered on an extensive review of the military construction of the 1940-1945 period, and its contribution to the history of World War II and the post-war Army landscape.

Because technology has advanced so rapidly since the war, post-World War II properties were also given attention. These properties were evaluated in terms of the Nation's more recent accomplishments in weaponry, rocketry, electronics, and related technological and scientific endeavors. Thus the traditional definition of "historic" as a property 50 or more years old was not germane in the assessment of either World War II or post-war DARCOM buildings and structures; rather, the historic importance of all properties was evaluated as completely as possible regardless of age.

Property designations by category are expected to be useful for approximately ten years, after which all categorizations should be reviewed and updated.

Following this categorization procedure, Category I, II, and III historic properties were analyzed in terms of:

- o Current structural condition and state of repair. This information was taken from the field inventory forms and photographs, and was often supplemented by rechecking with facilities engineering personnel.

- The nature of possible future adverse impacts to the property. This information was gathered from the installation's master planning documents and rechecked with facilities engineering personnel.

Based on the above considerations, the general preservation recommendations presented in Chapter 3 for Category I, II, and III historic properties were developed.

NOTES

1. Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures (unpublished draft, 1982).

2. Representative post-World War II buildings and structures were defined as properties that were: (a) "representative" by virtue of construction type, architectural type, function, or a combination of these, (b) of obvious Category I, II, or III historic importance, or (c) prominent on the installation by virtue of size, location, or other distinctive feature.

3. National Park Service, How to Complete National Register Forms (Washington, D.C.: U.S. Government Printing Office, January 1977).

4. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).

Chapter 2

HISTORICAL OVERVIEW

BACKGROUND

Picatinny Arsenal occupies approximately 6,500 acres in a valley bordered by Picatinny Peak and centered by Lake Picatinny in Rockaway Township, New Jersey. The site was established by the Department of War as the Dover Powder Depot in September 1880 (later known as Picatinny Powder Depot and the US Powder Depot). In 1891, 315 acres of property were ceded to build a naval powder depot.

During the first decade of this century, temporary facilities were begun for explosive loading and projectile filling plants, and later a smokeless powder production facility was established. During and following World War I, the arsenal earned a reputation as the Army's authority on the manufacturing of ammunition. The installation contains over 1,500 buildings, approximately 25% of which are storage facilities and another 25% of which are designated for research, development and testing. Most of the buildings at Picatinny were constructed during the 1930s and 1940s to replace those destroyed by a accidental series of explosions at the adjacent Lake Denmark Naval Powder Depot on July 10, 1926.

A positive side effect of the 1926 Explosion was that by World War II Picatinny Arsenal was operating with new facilities and was capable of coping with wartime

demands. In addition to its role as manufacturer, Picatinny Arsenal also provided technical information, guidance and training to private industry which produced ammunition to satisfy wartime requirements. Following the war, Picatinny maintained production capabilities utilized during the Korean and Vietnam conflicts. Simultaneously, the Arsenal continued to develop and test new conventional and nuclear weapons systems.

Pre-Arsenal History

The site of Picatinny Arsenal has a history of munitions manufacturing dating from colonial times. In 1749, the Middle Forge, located at the foot of Picatinny Peak on the southern end of Lake Picatinny, was established by Jonathan Osborne. In 1772, Colonel John Ford, owner of the black powder mills in nearby Morristown, acquired the forge and later deeded it to his son John Ford, Jr. John Jacob Faesch, a Swiss immigrant and master iron worker, then leased the forge from the Ford family and acquired it upon John Ford Jr.'s death in 1778. During the Revolutionary War, Faesch provided the Continental Army with bar iron, cannon, shot, shovels, axes and other iron implements. George Washington reputedly visited the Mount Hope Ironworks, which included the Middle Forge, during the war and definitely provided Faesch with Hessian prisoners to assist in its operations.[1]

Following the war, Faesch became a prominent member of the community serving as Morris County delegate to the New Jersey State Convention which ratified the Federal Constitution.[2] Upon his death in 1799, the Mount Hope Ironworks and other extensive iron properties passed into his sons' hands. They were unable

to run the works profitably and sold them in 1809. Moses Phillips purchased the Mount Hope Ironworks and operated it as the Aetna Forge until 1839, when Jacob Righter became owner.[3] Upon his death in 1853, the complex was left to his son, George E. Righter, who sold the property to the Federal Government in 1879. The early 19th century iron industry in New Jersey was a profitable one. The period from 1804 to 1816 was prosperous, but there came a depression in 1820. The decade from 1830 to 1840 was again profitable due primarily to a technological change in 1837 that introduced the hot blast process. However a stone coal manufacturing process led to the ultimate demise of the iron industry in the Northeastern United States. At the height of its operation, the ironworks reportedly employed 60 men and produced 10-20 tons of the iron per week. The forge trip hammer, weighing 600 pounds, and the anvil, two feet square and weighing some 4,000 pounds, along with other tools are on exhibit at Picatinny Arsenal.[4]

Purchase of the Tract by the US Government

The history of public involvement at the Picatinny site begins with the changes in military preparedness as a result of the Civil War. As early as 1862, the Chief of Ordnance had urged the army to begin construction of a "Grand Arsenal" on the Atlantic seaboard. In 1866, a Board of Governors was convened by the Ordnance Department to consider the establishment and location of two powder depots on the East Coast. The requirements of the board included: (1) that the region selected be sparsely populated; (2) that the capability exist to store a large amount of powder in a location near New York City; and (3) that the site chosen be accessible to rail transportation.[5]

In 1875, legislation was passed by Congress urging the Secretary of War to examine the arsenals east of the Mississippi River and report on the number that could be closed and sold. The Sundry Civil Bill of March 1875 included this directive:

> "The Secretary of War is hereby directed to cause an examination to be made into the condition of the United States Arsenals east of the Mississippi River; and report to the next Congress how many of the same can be sold without interfering with the necessities of the military service, together with an estimate of the amount that can probably be realized from the sale of each of the same whenever such sale shall be directed by Congress.[6]

The Board of Governors which convened as a result of this directive recommended that the Watertown, Watervliet, Pikeville, Washington, Allegheny, Columbus, and Detroit Arsenals be sold, and a Grand Arsenal, to include a proving ground and powder depot, be built with the proceeds.

An Ordnance Department committee, headed by Lt. Col. Silas Crispin, was appointed in March 1875 to determine the location for a Grand Arsenal. In 1879, $50,000 was appropriated for the purchase of land for a powder depot. Maj. Francis H. Parker of the Ordnance Department was ordered to examine potential sites and in July 1879, he personally inspected land near Dover, NJ; Bricksburg, NJ; Cornwall, NJ; Ellenville, NY; Rosendale, NY; Sloatsburg, NY; Cold Springs, NY; and West Point, NY. These locations had in common rural seclusion, proximity to New York City, and convenient access to transportation networks.[7]

A second committee of the Board of Governors convened in October 1879 to choose and purchase a site for the Army's Grand Arsenal on the East Coast. This board included Lt. Silas Crispin, Maj. F.H. Parker and T.G. Baylor.

Based on Parker's findings, the Board selected a site near Peekskill, NY, and instructed Parker to inquire about its purchase. Though ideally suited for the Army's purposes, the cost of the Peekskill tract was prohibitive.[8] On February 9, 1880, pressed to find a site by the end of the fiscal year, the Board recommended a tract in Queensboro, NY. However, acquisition again proved difficult. On February 26, the Dover, NJ, site was suggested though there was some question of its security from coastal invasion.[9] Brigadier General Stephen Vincent Benet, Chief of Ordnance, quelled these concerns by personally endorsing the Dover site:

> "The geographic location near Dover is sufficiently well protected, being behind the fortification of N.Y. Harbor, nestling high among the mountains, 45 miles distant, with a closely built and highly cultivated country, and very large population intervening."[10]

The Ordnance Board completed arrangements for the purchase and 1,866.12 acres was acquired by the government for $62,750, or about $30 per acre:

Date of Purchase	From Whom Purchased	Area	Amount
September 4, 1880	George E. Righter	1,195.80	$35,874
September 8, 1880	W. H. Wiggins	167.32	$ 8,500
November 17, 1880	Edward C. Fieldler	304.20	$ 9,126
February 7, 1881	Henry and Michael Doland	11.00	$ 750
April 20, 1881	John E. Kindred	187.80	$ 8,500

A strip of land to be used as a roadway was bought from Louis H. Spicer on May 2, 1881. Leading from Spicertown, an unincorporated village in Rockaway Township, to the depot grounds, the parcel, 50 feet wide and 7,412 feet long, added about 8.5 acres to the site.

The decision to locate a Army installation in the rural area of northern New Jersey was a significant event in the development of Morris County. The Morris County weekly, The Jerseyman, reporting on the occasion of the purchase, noted that "the improvements and changes, together with the appearance of United States officers and soldiers, will make a great change in that part of the county."[11]

Construction for Powder Storage: 1880-1890

The new depot's first decade witnessed construction of storage magazines, officers' quarters, stables and service buildings. The first structure, a powder magazine measuring 200 x 50 feet with a six foot basement, was started on September 16, 1880 and completed in 1881 at a cost of $51,700. It was designed to store 10,000 lbs. of black powder. Piers and foundations were of stone quarried at the site. Yellow pine flooring was supported on brick arches spanning heavy wrought-irons beams leveled with concrete. The ceiling, supported by a row of cast-iron columns down the center of the building, consisted of brick arches and wrought-iron I-beams with roof trusses of wrought iron.[12] The magazine was reported to contain 200,000 lbs. of iron, 450,000 bricks, and 14,000 cubic feet of granite in the piers, foundations and lintels.[13]

By early 1882, the 150 men employed at the depot were primarily engaged in stone quarrying and building construction. In May 1882, however, the original government appropriation was depleted and the remaining workers, only 22 men,

were engaged in farming the land.[14] A second appropriation, in the summer of 1882, allowed construction to continue. By June 1883, a work force of 75 men was finishing work on the second powder magazine which was completed by the end of 1883.[15] The third and fourth magazines and an office were completed in 1885, while the fifth "original" magazine was not completed until 1890.[16] Ordnance Department Chief Brig. Gen. Benet approved the first plan for the Picatinny Powder Depot in 1885. This plan included 11 storage magazines, a stable, foreman's quarters, an office, an engine house, a store, a shop and other sites planned for future buildings.

The Cannon Gates were installed in October 1885 to provide the new installation with an appropriate entrance. The Gates, constructed by the Cornell Iron Works, was patterned from a special design which used heavy cannon mounted on stone foundations to serve as posts for the wrought-iron gates. The gates themselves were decorative wrought-iron, embellished with the insignia of the Ordnance Department. The Dover Era, praised the new work as "a very artistic and imposing entrance."[18] The first shipment of powder, 300,000 lbs. of a hexagonal type, was sent to the depot for storage in November 1886.[17]

By June 1887, 23.5 miles of track connecting the Army depot with the Delaware Lackawanna and Western Railroad and the Dover and Central Railroad of New Jersey at Wharton had been laid by the Morris County Railroad Company of New Jersey under the terms of a 9-acre right-of-way granted by a 99-year lease.[19] In July 1887, 70 men were employed at the depot and 900,000 pounds of powder were in storage.[20] In 1889, it was announced that 4,500 tons of saltpeter used in the production of black powder were to be stored there.[21]

Establishment of the Navy's Lake Denmark Powder Depot, 1891.

In 1890, the Department of the Navy transferred its powder magazine on Ellis Island in New York Harbor to the Treasury Department. This left the Navy without an adequate powder storage facility on the East Coast. By act of Congress, approved April 11, 1890, $75,000 was appropriated to purchase a new site for a powder depot.[22] The site selected was located at Lake Denmark, New Jersey, and was part of the Army's Picatinny Powder Depot. Lake Denmark was chosen for many of the same reasons that attracted the Ordnance Department and title for 315 acres was formally ceded to the Navy on June 9, 1891. Ground was immediately cleared for construction.[23]

The Lake Denmark Powder Depot was the Navy's principle East Coast facility and was intended to be the general storage depot for all powder and high explosives.[24] The first structures, a magazine for the storage of powder and explosives, a shell house, and three small frame houses for Navy caretaker personnel, were completed in 1892, by a local contractor, J. J. Vreeland, who had also worked for the Army at the site.[25] By 1894, the depot also included three large buildings for the storage of powder and ammunition, two smaller structures for the storage of high explosives and one large building for loading artillery shells.

The early history of Lake Denmark is one of gradual but steady expansion. The Spanish-American War (1898-1899) and the growing needs of the Navy contributed to the development of the facility. Two additional tracts of land were acquired in 1902 - a parcel of 78.58 acres by purchase and a second tract of 67.5 acres, confiscated by Presidential proclamation.[26]

America's involvement in World War I (1917-1918) placed increased demands on the powder storage facilities of the East Coast. After the war, an overload of ammunition created new demands for powder and high explosives storage facilities. To meet these needs, new storage magazines were constructed at the Lake Denmark Powder Depot to accommodate the increased demands and burdens of a rapid national development.[27]

Early Projectile Loading: 1897-1906

Several small-scale loading operations were begun at the depot in the late 19th and early 20th centuries. The assembly of powder charges for cannon began on the Army post in 1897. This process involved the manufacture of silk cartridge bags to contain the powder charge and the filling of charges for separately loaded ammunition. As a result, buildings for the storage of loaded projectiles and explosives were required. By 1902, six magazines for the storage of sodium nitrate and filled projectiles had been constructed.

A temporary plant for loading armor-piercing projectiles with Maximite, including a boiler house and a loading house, was constructed in 1903. Several thousand projectiles were manually filled and compressed before Explosive "D" completely supplanted Maximite. The shells which had been loaded with Maximite were unloaded in 1906-7.[28] A plant for loading shells with Explosive "D" was completed in 1904 and continued in operation until 1906 when a policy of loading projectiles in the field was instituted.[29]

The expansion of operations at the Army post required construction of new service buildings and laboratories. By 1906, a water powered wheel and dynamo house was constructed at the southwestern corner of La e Picatinny; a metal working shop was built; and a building in which to assemble fixed ammunition was constructed. However, plans for this activity were abandoned and the building was converted to a chemical laboratory and later to a high explosives plant. By 1906, there were 105 buildings on the Army base.

Early Production Phase: World War I (1906-1918)

Congress passed the fortification bill on June 25, 1906 authorizing $165,000 to build and equip a major powder manufacturing site for the Army. A Board of Officers, consisting of Lt. Col. Roger Birnie, Major Beverly W. Dunn and Major Odus C. Horney, was appointed to select a site for the factory. The board reviewed Fort Montgomery near West Point, Rock Island Arsenal, St. Louis Arsenal, and the United States Powder Depot as possible locations. The Chief of Ordnance recommended the New Jersey site to the Secretary of War. In 1907, this location was chosen as the first Army-owned smokeless powder plant.[30] In October 1907, the installation's name was officially changed to "Picatinny Arsenal."

Major Dunn, the inventor of Explosive "D," was detailed to supervise building the powder factory on May 14, 1907. Dunn prepared the plans, but left shortly thereafter for a position with the American Railway Association. Work on the powder factory began in April, 1907 under Major Horney, who was given command of the post on June 10, 1907.[31] The buildings were completed in eight

months and the manufacture of cannon powder begun in January 1908. The plant had an initial production capacity of 3,000 pounds of powder daily. This facility differed from other powder factories in the United States because it employed the Thompson displacement process in the nitration of cotton.[32] This process was later replaced by the Dupont Centrifugal Wringer Process.

In 1908, equipment for the manufacture of powder for small arms of .30 caliber was installed. The original capacity of this plant was 250 to 300 pounds of small arms powder per day.[33]

In 1909, Picatinny became solely responsible for the assembly of fixed ammunition above .50 caliber. On March 4, 1909, Congress approved $175,000 for the expansion of its powder factory. Production capacity increased to 9,000 pounds of smokeless powder daily.[34]

In 1911, Congress authorized the expenditure of $20,000 was obtained construction of a plant to manufacture Explosive "D," an explosive used as a bursting charge in armor-piercing projectiles.[35] This plant was in operation by 1913 with a daily production capacity of 1,000 pounds.[36] It remained operational until 1918, when the factory was dismantled.[37]

In November 1911, an Officer's Training School was established to provide instruction in the chemistry of explosives and ballistics. Training was in the ammunition manufacturing process and War Department methods.[38] By 1913, employment at Picatinny stood at 200. In 1914, 124 buildings were located on the site.

With the entry of America into World War I, there was a need for additional storage capability for powder and other ordnance materials. Fifty-four new storage buildings, a new powder house, a locomotive round house, garages and more office space were constructed. More roads were planned and new railroad right of ways were established. During the war the Arsenal hired 2,600 workers to meet war time production needs.

The post's most significant role during World War I was not the manufacture or loading of projectiles, since private firms (Dupont, Hercules, Aetna, and Atlas Powder) received contracts from the Army to produce the bulk of explosives. Rather, Picatinny Arsenal served as an important munitions training and research center and provided a liaison between the Army and private industry. The work accomplished during World War I established Picatinny Arsenal as an important research installation, and helped insure it a significant post-war role.

Early Experimental Phase: 1918-1926

After the Armistice in November 1918, the production of powder was halted and the arsenal served as a field depot for one year for the storage of surplus powder. Employment declined from 2,600 to 1,300; by 1919-20 it dropped further to between 600 and 1,000. However activities soon accelerated as a plant for manufacturing pyrotechnic flares and signals was established and a small experimental plant for artillery ammunition was begun.

Major developments soon began that would sustain the post between the wars and establish Picatinny Arsenal as the major center for explosives research and development. The Ordnance Department decreed on December 28, 1920 that it would be a complete ammunition arsenal. An intensive building and renovation program was launched and all the Army's research on fuzes was transferred to the site. Nine buildings were constructed for drying, grinding and sieving explosives such as dicyandiamid, quaridine nitrate and pentaerythrite. Storage tanks for raw materials and a control laboratory were also constructed.[39] Plants were established for loading TNT and Amatol into bombs and shells and to load fuzes and assemble complete rounds. Fifty buildings, including the powder factory, were renovated for new experimental work. To support these expanded facilities, the physical plant was modernized to include new steam, electric and sewage lines and the power house was refitted with new boilers and generators. By 1922, Picatinny Arsenal contained 485 buildings.[40]

Explosion At Lake Denmark Powder Depot, July 10, 1926

Around 5:15 on the afternoon of Saturday, July 10, 1926, a severe electrical storm hit the Dover area and lightning struck the southwest end of the Naval Powder Depot. Attempts to contain the resulting fire proved futile. At 5:20, a tremendous explosion outside temporary Magazine No. 8 caused considerable damage to it and other magazines in the vicinity, thus exposing their contents to flame and shrapnel. As a result, fires spread rapidly and a series of sympathetic explosions occurred throughout the area. At about 5:25, the contents of Storehouse No. 9, 150 feet distant from Storehouse No. 8, exploded.[41]

Temporary Storehouses No. 8 and 9 were of typical storehouse construction: one story hollow clay tile and brick buildings with steel roof trusses. Roofs were wood with tar sheeting. Both buildings were equipped with lightning rods. Temporary Storehouse No. 9 held 1,600,000 lbs. of TNT stored in boxes. Storehouse No. 8 contained an estimated 670,000 lbs. of various types of explosives from depth charges to bomb fuzes. A third explosion leveled Shell Storehouse No. 22 which contained 180,000 lbs. of loaded artillery shells and fuzes. Fortunately, 2,500,000 lbs. of Explosive "D" stored in Storehouse No. 11 (500 feet from the blast area) burned rather than detonated thus avoiding another major explosion.[42]

The detonations triggered tremendous shock waves and caused a series of destructive reverberations. Everything within a 3000 foot radius of the blasts was destroyed. Beyond 3,000 feet, many buildings in the Naval depot were seriously damaged.[43] Steel structural members were twisted and bent by the pressure waves, tile walls were pulled down by falling steel trusses, and many fragments were sent flying by the blast. Brick walls often remained standing, but generally were fractured and left structurally unsound. None of the Navy's 160 buildings was untouched by the tremendous force of the explosion.

The explosion also did considerable damage to buildings at Picatinny Arsenal because of its location in the valley directly below the Navy's depot. This included many buildings associated with the Nitrocellulose Smokeless Powder Plant. The two-story Boiling Tub House (distance 1,250 feet) and the Poaching House (distance 1,400 feet) were completely destroyed. The Ether/Alcohol Building's steel frame (distance 1,650 feet) was not structurally damaged,

though all the iron siding was blown off and the Dehydration, Mixing, and Pressing Building (distance 1,900 feet) suffered damage to its steel structure and tile walls, though the concrete partition walls remained standing.[44] The explosion damaged many important production buildings within 2,000-3,000 feet of the blasts. Among these were the Tetryl Manufacturing Building (distance 2,050 feet), the TNT Purification Building (distance 2,200 feet), and the Ammonium Picrate Purification Building (distance 2,250 feet). Because of their reinforced concrete frame these buildings did not collapse, but their tile infill walls and windows were heavily damaged.

A number of storehouse buildings (2,300 feet distance) were demolished by the force of the explosion. These buildings were generally constructed on concrete foundations with brick or hollow tile walls, and had gable roofs supported by steel roof trusses. Damage to these buildings was caused by extreme air pressure from the explosion. Most of the gable roofs had a 1:4 pitch, and were not designed to withstand the direct perpendicular force of the explosion. As a result, roof trusses collapsed and often pulled down tile or brick walls.[45] Damage to buildings located more than 3000 feet from the blast area was less severe. Many buildings had roof trusses which were partially destroyed, but their walls remained intact. Other buildings suffered only moderate damage such as broken windows or slightly crushed roofs, but wood frame or temporary structures were generally devastated.[46]

The explosion at the Lake Denmark Powder Depot also caused considerable damage to civilian property. Many towns in the area reported damage, the most serious occurring in Mt. Hope (1 mile away), Hibernia (3-1/4 miles away), and Rockaway (3-1/2 miles away). An area of ten square miles was evacuated.[47]

Nineteen persons were killed including 16 military personnel and three civilians.[48]

After World War I, the Navy was burdened with excessive amounts of unused ammunition and faced the difficult problem of storing these vast reserves of high explosives, smokeless powder, and inert materials. A great number of magazines were constructed at Lake Denmark during 1917-1918 to increase the capacity of East Coast storage depots. However, this effort was inadequate as all the East Coast storage facilities were quickly filled to capacity.[49]

The 1926 Explosion at Lake Denmark demonstrated the hazards of storing concentrated amounts of explosive materials. At the time of the explosion, both Storehouses No. 8 and No. 9 were dangerously overloaded and in violation of the laws of New Jersey relating to the manufacture, keeping, storage, transportation, and sale of explosives. These conditions were a contributing factor to the extensive damage caused by the 1926 Explosion.[50]

Aftermath of the 1926 Explosion

Salvage and clean-up operations could not begin at Lake Denmark or Picatinny Arsenal until all fires were completely extinguished. Two weeks were required to extinguish all fires before it was safe to begin the task of cleaning up debris, salvaging materials and filing damage reports.

In the area of the original detonation, great quantities of twisted steel girders, steel shrapnel, and brick fragments were widely strewn. Three distinct craters, on the sites of the three storehouses, marked the location of the original explosions. Unexploded shells and shell fragments, some as far as 3/4 mile from the site of Shell Storehouse No. 22 posed great problems for cleanup crews.[51]

300,000 tons of loaded and fuzed projectiles damaged by the explosion were transferred by rail to a Navy installation at Iona Island in the Hudson River and then dumped at sea. Some damaged fuzes and primers were burned on site. Salvaged materials included 7,809 tons of metal, which was sold for $191,910.[52] Other explosive materials were bulldozed into craters and covered over (as a result, two sites in the Navy Hill area remain quarantined today).

The Court of Inquiry, appointed by the Navy and headed by Rear Admiral Coontz, recognized the problem of inadequate ammunition storage facilities on the East Coast. The court's most urgent finding was for the segregation of high explosive storage facilities. In effect, the court's recommendation's led to a general revision of ammunition storage practices and three recommendations were made to the Secretary of the Navy:

1) The amount of high explosive material stored in any given facility should be limited to 143,000 pounds per magazine.

2) High explosive magazines should be constructed with a minimum allowable distance of 500 feet between buildings.
3) New design standards should be developed for the construction of storage buildings.

The Court of Inquiry also recommended that combustible materials, materials with low resistance to explosion, and materials with a tendency to fragment into hazardous missiles be eliminated from the construction of ammunition storage buildings.[53]

To relieve the problem of explosive storage congestion, the Court recommended that two ammunition depots -- one serving the East Coast, the other serving the West Coast--be specifically designed to store high explosives. Both ammunition depots were to be at least 100 square miles in size and be located in isolated areas.[54]

In response to the court's suggestions, 77 specially designed high explosive storage buildings were planned for the Navy's Mine Depot at Yorktown, Virginia. This installation, located on a large tract of property, was to serve as the Navy's East Coast high explosive installation. A large ammunition depot for the West Coast was located on a 140 square mile tract of land near Hawthorne, Nevada, and included 1,100 arch-type high explosives magazines.[55] The court was confident that completion of these new facilities would greatly relieve the congestion on the East Coast.

The Court of Inquiry further recommended that after salvage and repairs were completed at Lake Denmark, funds should be appropriated to construct six new storage magazines to be used only for storing inert material, propellant powder, and projectiles. Storage of live ammunition at Lake Denmark would no longer be permitted.[56]

Further ramifications of the Lake Denmark explosion provoked Congress to investigate all government-owned ammunition storage and explosive manufacturing facilities that posed a threat to civilian populations and private industry. The first Deficiency Act, signed by the President on December 22, 1927, requested the Secretary of War and the Secretary of the Navy to appoint a joint board of investigators to survey Army and Navy ammunition installations and report their recommendations for upgrading existing facilities and building new facilities.[57]

Reconstruction Phase 1926-1937

Following the explosion of July 10, 1926, the Chief of Ordnance appointed a board of Army officers to investigate the incident and to make recommendations on the future of Picatinny Arsenal. The commission, headed by Col. Tschappat, advised that Picatinny Arsenal be reconstructed and expanded to consolidate the Army's holdings in northern New Jersey.[58]

In reviewing the damage caused by the 1926 Explosion, three major factors were found which affected the extent of damage inflicted upon a building:

1) The distance from the explosion.

2) The structural strength of a building.

3) The extent to which a building was screened or protected from the direct impact of the blast.[59]

Rather specific conclusions could be drawn from analysis of the damage. For instance, reinforced concrete was discovered to be the most satisfactory building material because it best resisted shock waves. Buildings incorporating reinforced concrete barricades, partition walls and structural frames were not seriously damaged. Brick construction, while not as durable as concrete, was often able to withstand the shock of the blasts. Hollow tile walls generally did not have the strength to withstand the damaging effects of an explosion. However, tile was an effective material for non-structural infill walls because it did not form dangerously destructive shrapnel material. The weakest structural aspect of building construction was the standard gable roof truss. Additional bracing substantially strengthened the traditional gable, but flat roofs proved far more resistant to the damaging effects of a blast.[60]

Prior to 1926, the expansion of Picatinny Arsenal had been gradual in order to meet the changing demands and functions of the Army. The 1926 Explosion provided an opportunity to redesign the installation to meet the Army's specific and particular requirements. The Tschappat Board recognized these possibilities and reported:

> "During its inspection of damage to the Arsenal, the board considered the rearrangement of certain facilities with a view to greater safety and economy of operation. The board believes that facilities not involving explosives or unusual hazards should be separated from facilities involving such hazards by as great distances as practicable, when such separation can be effected without undue increased cost of operation of the plant as a whole.[61]

In December 1927, Congress approved plans for rehabilitating Picatinny Arsenal and appropriated $2.3 million in line with the Tschappat Board's recommendations for this purpose. Lt. Col. J.K. Crain, Ordnance Department, was appointed to direct its reconstruction. Essentially, the "new" Arsenal was divided into three distinct functional zones:

1) An area for the production of powder and explosives.

2) An area for testing powders and explosives.

3) An area for non-explosives manufacturing, including all research and administrative facilities.[62]

The prime reconstruction effort focused on the powder and explosives manufacturing area. The Nitrocellulose Smokeless Powder Plant (the 500 area) was built on its original site, with greater distances between buildings. A Complete Rounds/Melt-Loading Plant (800 area) was established along the west shore of Lake Picatinny. This was constructed as a major loading-line, designed to incorporate various loading procedures into one distinct production component. Four major loading and assembly buildings were constructed, connected by covered walkways to facilitate the production process. The Complete Rounds/Melt Loading Plant represented a major development in production conception and greatly enhanced Picatinny Arsenal's production capability.

A new Bag-Loading Plant (400 area) was established along the south shore of Lake Picatinny. Three major buildings which replaced the outmoded facilities were constructed specifically for this production process.

A new testing area (600 area), established on the plateau west of Picatinny Peak, consisted of structures specifically designed as testing facilities and marked advances in technological and scientific developments.

A small High Explosives Plant (1000 area) for the production of tetryl was constructed in an isolated area on the eastern ridge of Picatinny Peak. The new plant followed construction guidelines established by New Jersey State law and replaced the old Tetryl Plant.

The explosives storage area (900 area) remained essentially unchanged. However, several recommendations concerning safety procedures were adopted and many new sand-filled wood bunkers were constructed. The amount of ammunition stored at Picatinny Arsenal was reduced and, to insure the safety of surrounding areas, Congress appropriated funds for the purchase of additional lands.[63]

A new administrative building (Building 151) and a new chemistry laboratory complex (Building 162) were the major construction projects executed in the non-explosives manufacturing area. These two projects formed the nucleus of a new administrative district. The emphasis placed on administrative functions, and especially on research facilities, reflected a shift in the focus of the arsenal.

The reconstruction and expansion of Picatinny Arsenal established the installation as the Army's major ammunition facility. It also became the Army's development, research and manufacturing center for all types of ammunition, except for small arms and machine guns.[64]

The rehabilitation of Picatinny Arsenal was essentially completed by 1931 as the new production plants and research facilities were all operable. During the 1930s, additional maintenance and repair work was completed as part of the Works Projects Administration (WPA). Nine hundred WPA workers were employed in 1937 to make renovations and improvements.[65] By 1940, there were 567 buildings at Picatinny Arsenal. There were 342,000 square feet of storage space; the value of items stored was $37.5 million and the facility itself was valued at close to $10 million.[66] Picatinny Arsenal, having suffered tremendously from the explosion of July 10, 1926, had been completely revived.

World War II Production Phase (1938-1945)

The mission of Picatinny Arsenal, just prior to America's involvement in World War II, was to provide the Army with a munitions manufacturing center which included experimental and production plants for various propellants and high explosives. In 1940, the installation was producing the following materials at either experimental or peace-time production levels:

1) Smokeless Powder
2) High Explosives
3) Fuzes and Primers

4) Assembled Rounds of Artillery Ammunition

5) Bombs and Grenades

6) Pyrotechnics (Airplane Flares/Military Signals)

Picatinny Arsenal was an important explosives and ammunition research center. Though work was interrupted briefly by the 1926 Explosion, the Arsenal's research/development facilities served both the Army and private industry during the period between the wars. From 1918-1940, Picatinny Arsenal was responsible for the standardization of new designs for base- and point-detonating artillery fuzes, and for the development of nose and tail bomb fuzes. Picatinny Arsenal was also instrumental in redesigning and improving artillery primers, trench mortars, and rounds of chemical and tracer ammunition. New high explosive compounds, propellant compositions, fuze powders, primer mixtures and pyrotechnic compositions were developed by the Research and Chemical Branch. An important aspect of Picatinny Arsenal's mission was the development of up-to-date designs for munitions, and in the event of a national emergency, to provide private industry with production plans and training.[67]

On December 8, 1941, the United States was at war and private industry faced a major challenge to meet the demands of mass production. Of necessity, Picatinny Arsenal assumed an important role in:

1) Ammunition Manufacture/Production

2) Ammunition and Explosives Research

3) Civilian and Military Personnel Training

At the outbreak of the Second World War, Picatinny Arsenal was responsible for producing most of the ammunition for American troops as well as much of the ammunition for our European Allies. It was the only major plant in the United States capable of full-scale production for any ammunition larger than small arms, and it was responsible for loading and assembling large caliber ammunition, artillery projectiles and bombs. Picatinny Arsenal remained the nation's only major munitions producer until the fall of 1942 when private industry was capable of accepting the burden.[68]

To meet these responsibilities, Picatinny Arsenal experienced another era of rapid expansion. Pilot plant and experimental projects were converted to production operations. Production lines were operated at full-scale and then expanded in order to cope with increasing needs. The facility operated 24 hours a day, 7 days a week; the work force grew from 1,800 to 18,000 workers. To meet their needs, the Army established temporary worker's housing outside Dover. A portion of the employees lived in this housing, while many commuted from areas as far away as Newark and New York City.

During 1942, the production at Picatinny Arsenal expanded far beyond the Army's expectations:

PRODUCTION FIGURES PICATINNY ARSENAL[69]

Year	Production/Rate
1938	2,000 boosters/8 hr day
1942	72,000 boosters/24 hr day
1938	600 artillery fuzes/8 hr day
1942	173,000 artillery fuzes/24 hr day
1938	10,000 primers/8 hr day
1942	90,000 primers/24 hr day
1942	40,000 37mm complete rounds/24 hr day
	30,000 60mm complete rounds/24 hr day
	12,000 75mm complete rounds/24 hr day
	7,500 81mm complete rounds/24 hr day

The Technical Division was established in March 1925 and was responsible for all research and development work during World War II. Many important advances were realized during the war which developed new products or simplified production. Perhaps the most significant of these was development of an improved method for manufacturing Tetryl, a highly explosive material used as a booster charge in bombs and artillery shells. The new procedure, which discontinued the dimethylaniline process in favor of the dinitromonomethylaniline process, proved less hazardous and less expensive.[70]

Improvement in the production and composition of nitrocellulose powder was accomplished by the Propellants Sub-Section of the Technical Division. The first development was the discovery that wood-pulp could be substituted for cellulose-based powders. This was extremely important because of the scarcity of cotton.[71] The Propellants Sub-Section was also responsible for studies of powder ignition and for standardizing testing procedures.[72]

There also existed an important demand for flashless, non-hydroscopic cannon powders. The research staffs of Picatinny Arsenal and the DuPont Company were responsible for developing powder compositions to meet these specifications. DuPont developed the M_1 powder; Picatinny developed the M_3. Testing of both compositions at the arsenal was done for specific weapons (three-inch and 90 mm) with satisfactory results.[73]

The Mechanical Branch of the Technical Division was responsible for the design and development of ammunition. At the outbreak of World War II, the branch was responsible for the development of all artillery fuzes, boosters and grenades. During the war, a variety of special components were designed to meet the requirements of different warfare tactics. Special bomb fuzes were designed-- one for above ground detonation and another for long delay (1 to 144 hour) detonation. Pyrotechnic devices, flares and signals were designed or improved. All these devices were developed and tested at Picatinny Arsenal before undergoing further testing or combat action.[74]

The Chemical Engineering Section of the Technical Division was responsible for developing and evaluating new explosives and improving the performance of standard military explosives. Its most significant accomplishment was the invention of Haleite. Named for Dr. G. C. Hale, Chief of the Chemical Branch, this explosive was developed in co-operation with DuPont. A small production plant was established in the old Tetryl area.[75]

The third significant function of Picatinny Arsenal was the establishment of training programs to impart knowledge of explosives and powder production to military and civilian personnel. The Ordnance School trained 300 reserve officers and 4,000 key ordnance personnel for special ordnance assignments. The men were later stationed among the 12 ordnance districts, to aid in establishing and maintaining ordnance facilities. To accelerate the transfer of ammunition production from the Army to the private sector, 530 engineers, chemists and executives from various industries studied ammunition and explosives production at Picatinny Arsenal.[76]

Picatinny Arsenal also developed a training program for 5,300 employees, the benefits of which were reflected in its excellent safety record. From 1940-1943, the facility's accident rate declined from 25.7 to 4.04 accidents per million man hours.[77]

The Arsenal's record proved that adequate safeguards and proper training could minimize hazards without jeopardizing the production output of an explosives manufacturing plant and demonstrated that the concept of "safety" in the explosives industry was possible.

The significance of the Navy's Lake Denmark Powder Depot in World War II is minor compared to Picatinny Arsenal. Though virtually destroyed by the 1926 explosion, Lake Denmark had since been used chiefly as a storage area for

propellants and loaded projectiles. During World War II, the Navy's installation continued to operate in this capacity while it expanded in size. The Marine Corps barracks and a storage area (3300 area), comprising a total of 24 structures, were completed in 1939. A number of ordnance facilities were built during the war, most notably a heavy ordnance storehouse (Building 3050) completed in March 1942. In 1943-1944, a new barracks area was constructed to provide housing for enlisted men preparing to go overseas. Although this study could not discover any official documentation, it was alleged that this area (3400 area) was built to serve as a prisoner of war camp during the last years of the war. The area was constructed as a self-sufficient entity surrounded by a high security fence and served by its own powerhouse. Evidence of guard towers still remain but it is not believed that any war prisoners were ever held here.[78]

World War II represents the zenith of Picatinny Arsenal's production development. The achievements of Picatinny Arsenal were recognized on September 20, 1942 when the Army-Navy "E" Award was bestowed upon Picatinny Arsenal for excellence in the production of ordnance. A second "E" Award was bestowed in August 1943, in further recognition of the Arsenal's important role in the nation's military effort.[79] The technological advances of World War II created great opportunities for research and Picatinny Arsenal continued to develop new and more effective munitions during the post-World War II period.

Post-World War II Phase

Following World War II, the Cold War forced a continued posture of military readiness. Picatinny Arsenal was ideally suited to contribute to the national defense because it combined laboratory, production and testing facilities at one installation. Research and Development study areas included pyrotechnics, plastics, packaging, explosives, rockets and missile warheads. Picatinny Arsenal had long been involved in the field of pyrotechnics and continued in this capacity. It was responsible for all military pyrotechnic devices for the Army and the Air Force. Post-war activities in this field included the research, design, and development of photoflash cartridges for tracking missiles, photoflash bombs, flares, signals, smokes, tracers, spotting charges, and simulated charges.[80]

The Arsenal also continued its research in the packaging of ammunition, including the study of plastics and adhesives. The installation was equipped to measure the mechanical properties of plastics and adhesives and to mold experimental quantities of development items. Testing facilities included equipment that could simulate different climatic conditions and handling hazards.[81] A Naval Air Rocket Test Station (NARTS) was established at the former Lake Denmark Powder Depot in the early 1950s to research and test liquid and solid rocket fuels.

Activity at Picatinny Arsenal increased once again with the outbreak of the Korean conflict in 1950. North Korean use of the Russian-made T-34 Medium Tank posed a serious threat to American forces until a new 3.5 inch bazooka

capable of penetrating the tank's thick armor was developed. The rocket for this weapon was manufactured at Picatinny Arsenal on a pilot plant basis and was soon put into full-scale production.[82]

Research and Development work also continued throughout the Korean conflict. In 1952, researchers at Picatinny developed an atomic shell capable of being fired from an 250mm gun.[83]

Picatinny Arsenal's research in plastics gained importance as this type of explosive came to be more widely used in ammunition during the late 1950s and early 1960s. In December 1959, the Plastics Technical Evaluation Center (PLASTEC) for the Department of Defense was assigned to Picatinny Arsenal. PLASTEC was responsible for compiling and evaluating information on plastics in the fields of packaging, electronics, structural and mechanical uses.[84]

The post continued to be a major center for explosives research throughout the 1950s and 1960s. Research included high-speed photographic studies of the detonation of explosives and studies of the effects of nuclear radiation on explosives. These studies applied to nuclear and special weapons as well as to conventional munitions.[85] During the 1960s, there began development work on warhead sections for the Nike system — a family of ground-to-air, anti-missile missiles.[86] Picatinny Arsenal was also responsible for the development of warheads for other Army missiles such as the Hawk, Corporal, Honest John, Littlejohn, Lacrosse, Redstone, Pershing, Sergeant, SAM-D, Lance and Safeguard.[87]

During the Vietnam conflict, Picatinny Arsenal was responsible for the production of bomb fuzes, mortar shells, tank mines and other ammunition, until private industry could go into full-scale production. Picatinny was also responsible for the development of many sophisticated weapons systems.[88]

Historical Overview: Footnotes

1) According to Dr. Manny Meyers, the most accessible publication on the history of Picatinny Arsenal (War Plans Division, Plant Engineering Department, The History of Picatinny Arsenal, Vol. I Picatinny Arsenal, N.J.: 1931, reprint ed.: Facilities Engineering Division, 1976) is not always reliable in discussing the site's early history. Meyers recommends the typewritten manuscript "The History of Picatinny Arsenal" prepared by Capt. J.A. Rogers, Jr. for the War Plans Division, Plant Engineering Dept. in 1931. The foreward to this manuscript was signed by Lt. Col. J.P. Rose.

2) New Jersey Historic Sites Inventory, Mount Hope, (2662.7) Rockaway, Morris County, N.J.

3) War Plans Division, History of P.A., p. 5.

4) Ibid., pp. 6-7.

5) "A Brief History of Picatinny Arsenal," The Summit Herald, April 16, 1920.

6) Henry Muhlenberg, "History of Arsenals; Augusta, Benicia, Frankford, New York, Picatinny" (Typewritten manuscript, 1912) p.4.

7) Ibid.

8) U.S. Ordnance Department, Ordnance Reports, Vol. 3, 1860-1889. p.591.

9) Ibid., p. 592.

10) Ibid.

11) The Jerseyman (Morristown, N.J.), August 13, 1880, p. 3.

12) Muhlenberg, "History of Arsenals," p. 8.

13) The Jerseyman, July 30, 1886, p. 3.

14) The Jerseyman, May 26, 1882, p.3.

15) The Jerseyman, June 8, 1883, p. 3.

16) The Jerseyman, Oct. 2, 1885.

17) Dover Era (Dover, N.J.), Oct. 1885.

18) The Jerseyman, Sept. 3, 1886.

19) War Plans Division, History of P.A., p. 54.

20) The Jerseyman, July 29, 1887, p. 3.

21) The Jerseyman, March 15, 1889, p. 3

22) U.S. Department of Navy, Annual Report of the Secretary of the Navy for the Year 1890 (Washington: Government Printing Office, 1890, p. 255.

23) U.S. Department of Navy, Annual Report 1891, p. 231.

24) Ibid., p.19.

25) The Jerseyman, April 1, 1894.

26) Charles Platt, Dover Dates 1772-1922: A Bicentennial History of Dover, N.J. (Dover, N.J.: 1976), p. 229.

27) Ibid.

28) Muhlenberg, "History of Arsenals", p. 9.

29) Ibid., p. 54.

30) Ibid., p. 10.

31) War Plans Division, History of P.A., p. 57.

32) Arthur Pine Van Gelder & Hugo Schlatter, History of the Explosives Industry in America (New York: Columbia University Press, 1927) pp. 837 - 838.

33) War Plans Division, History of P.A., p. 54.

34) Ibid., p. 55.

35) Platt, Dover Dates, p. 225.

36) Muhlenberg, "History of Arsenals", p. 11.

37) Platt, Dover Dates, p. 225.

38) Ibid.

39) Capt. John P. Harris, Ord. Dept. U.S.A. "Loading Ammunition at Picatinny Arsenal." Army Ordnance Vol. VII, No. 37 (July-August 1926), p. 43.

40) Muhlenberg, "History of Arsenals", p. 56.

41) War Plans Division, History of P.A. pp. 72-74.

42) Ibid.

43) Ibid., p. 74.

44) Ibid., pp. 77-79.

45) Ibid., p. 85.

46) Ibid., pp. 83-84.

47) The Jerseyman, July 12, 1926.

48) U.S. Department of Navy, Annual Reports of the Navy Department for the Fiscal Year 1927. (Washington: Government Printing Office, [1928]), p. 270.

49) U.S. Department of Navy, Building the Navy's Bases in World War II, Vol. I. (Washington: Government Printing Office, 1947), pp. 323-325.

50) U.S. Dept. of Navy, Annual Report 1927; pp. 270-271.

51) War Plans Division, History of P.A., pp. 89-90.

52) U.S. Dept. of Navy, Annual Report 1928, p. 321.

53) U.S. Dept. of Navy, Annual Report 1926, p. 30.

54) U.S. Dept. of Navy, Building Navy's Bases WWII, p. 324.

55) U.S. Dept. of Navy, Annual Report 1927, pp. 270-71.

56) Ibid., p. 36.

57) U.S. Congress, House, Letter from the Acting Sec. of War Transmitting Proceedings of the Joint Board Composed of Officers of the Army and Navy to Survey Ammunition Storage Conditions, Pursuant to the Act Approved Dec. 27, 1927 (Public Law No. 2, 70th Cong.), H. Doc. 199 70th Cong. 1st Sess., 1928, p.1.

58) War Plans Division, History of P.A., p. 93.

59) Ibid.

60) Ibid., pp. 85-86.

61) Ibid., p. 93.

62) Ibid., p. 10.

63) U.S. Congress, H. Doc. 199, p. 1.

64) Works Projects Administration, The Survey of Federal Archives, Division of Professional & Service Projects. (The National Archives, Cooperating Sponsor), Inventory of Federal Archives in the States. Series IV, The Dept. of War No. 29. (Newark, NJ: The Historical Records Survey Project, 1940), p. 120.

65) Ibid.

66) Ibid.

67) Ibid., p. 120.

68) Picatinny Arsenal 1880-1944, Vol. 13, No. 3 (New York: Houghton Line, 1944), p. 41.

69) The Survey of Fed. Archives, Fed. Archives in the States, p. 120.

70) Col. W.E. Larned, Picatinny Arsenal 1879-1943, Development Plant for Bombs, Explosives, Pyrotechnics, & Artillery Ammunition. (Dover, N.J.: Picatinny Arsenal [1943]).

71) Ibid.

72) U.S. Picatinny Arsenal, Report of the Technical Division, (January, 1948), pp. 17-20.

73) Ibid.

74) Ibid., pp. 41-48.

75) Ibid., pp. 15-16.

76) Larned, Picatinny Arsenal 1879-1943.

77) Picatinny Arsenal 1880-1944, p. 48.

78) Recommended for further reading: John Mewha & George G. Lewis, History of Prisoner of War Utilization by United States Army, (Washington: Office of the Chief of Military History, Dept. of the Army, 1955).

79) Larned, Picatinny Arsenal 1879-1943.

80) "Research and Engineering" (Dover, N.J.: .Picatinny Arsenal, [1961], mimeographed), p. 20.

81) Ibid., p. 27.

82) J.P. Harris, Col. Ord. Corps, U.S.A., Picatinny Arsenal (Dover, N.J.: Picatinny Arsenal, 1953), p. 14.

83) "Research and Engineering", p. 72.

84) Ibid, p. 30.

85) Ibid, p. 67.

86) Erik Bergaust, Rockets of the Armed Forces (New York: G.P. Putnam's Sons, 1966), p. 42.

87) Research and Engineering, p. 84.

88) "Picatinny Provides a Life for Morris Co. Towns," Star Ledger, 24 April 1979.

Chapter 3

PRESERVATION RECOMMENDATIONS

BACKGROUND

Army Regulation 420-40 requires that an historic preservation plan be developed as an integral part of each installation's planning and long range maintenance and development scheduling.[1] The purpose of such a program is to:

- o Preserve historic properties to reflect the Army's role in history and its continuing concern for the protection of the Nation's heritage.

- o Implement historic preservation projects as an integral part of the installation's maintenance and construction programs

- o Find adaptive uses for historic properties in order to maintain them as actively used facilities on the installation.

- o Eliminate damage or destruction due to improper maintenance, repair, or use that may alter or destroy the significant elements of any property.

- o Enhance the most historically significant areas of the installation through appropriate landscaping and conservation.

Unlike historic properties at many other sites, many of the significant properties at Picatinny Arsenal possess little or no architectural importance, rather their importance stems from their association with a significant industrial process. Furthermore, in many instances the important industrial process is no longer in evidence, the original equipment having been removed, and the building abandoned or converted to non-production use. In such instances when demolition is required the most appropriate way to preserve the significant aspects of such properties may be through the documentation of the historic industrial process.

To meet these overall preservation objectives, the general preservation recommendations set forth below have been developed:

Category I Historic Properties

All Category I historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for nomination regardless of age. The following general preservation recommendations apply to these properties:

a)Each Category I historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category I historic properties should not be altered or demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory

Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

b)An individual preservation plan should be developed and put into effect for each Category I historic property. This plan should delineate the appropriate restoration or preservation program to be carried out for the property. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the aboved referenced ACHP regulation. Until the historic preservation plan is put into effect, Category I historic properties should be maintained in accordance with the recommended approaches ofthe Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings[2] and in consultation with the State Historic Preservation Officer.

c)Each Category I historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.[3] When no adequate architectural drawings exist for a Category I historic property, it should be documented in accordance with Documentation Level I of these standards. In cases where standard measured drawings are unable to record significant features of a property or technological process, interpretive drawings also should be prepared.

Category II Historic Properties

All Category II historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for nomination regardless of age. The following general preservation recommendations apply to these properties:

a)Each Category II historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category II historic properties should not be altered or demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

b)An individual preservation plan should be developed and put into effect for each Category II historic property. This plan should delineate the appropriate preservation or rehabilitation program to be carried out for the property or for those parts of the property which contribute to its historical, architectural, or technological importance. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above referenced ACHP regulations. Until the historic preservation plan is put

into effect, Category II historic properties should be maintained in accordance with the recommended approaches in the Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings[4] and in consultation with the State Historic Preservation Officer.

c)Each Category II historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.[5]

Category III Historic Properties

The following preservation recommendations apply to Category III historic properties:

a)Category III historic properties listed on or eligible for nomination to the National Register as part of a district or thematic group should be treated in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800). Such properties should not be demolished and their facades, or those parts of the property that contribute to the historical landscape, should be protected from major modifications. Preservation plans should be developed for groupings of Category III historic properties within a district or thematic group. The

scope of these plans should be limited to those parts of each property that contribute to the district or group's importance. Until such plans are put into effect, these properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings[6] and in consultation with the State Historic Preservation Officer.

b) Category III historic properties not listed on or eligible for nomination to the National Register as part of a district or thematic group should receive routine maintenance. Such properties should not be demolished, and their facades, or those parts of the property that contribute to the historical landscape, should be protected from modification. If the properties are unoccupied, they should, as a minimum, be maintained in stable condition and prevented from deteriorating.

HABS/HAER Documentation Level IV has been completed for all Category III historic properties and no additional documentation is required. In addition, Category III historic properties located in those process areas identified as significant (200, 400, 500, 600, 800 areas) are part of the HABS/HAER Documentation Level I which will be submitted for inclusion in the HABS/HAER collections in the Library of Congress.[7]

SIGNIFICANT PROPERTIES, ARRANGED BY AREA

BUILDINGS 1-99

After World War I the production of powder was halted temporarily and the Arsenal served as a field depot for the storage of surplus powder. Numerous storage structures were constructed of hollow red clay tile in what is now the central core area of Picatinny Arsenal. Although most of the buildings have undergone transformation to administrative and maintenance purposes and have in some cases been heavily remodeled, they possess limited significance because of their association with this early period of the Arsenal's history.

Category III Properties

Bldg. #	Bldg. Use (Historic Use)	Construction Date
2	Museum (Storage)	1918
3	Administration General Purpose	1918
4	Electrical Equipment Facility	1918
5	Operations General Purpose	1918
17	Flammable Materials Storehouse	1918
18	Laboratory General Purpose (Flammable Materials Storehouse)	1918

19	Electrical Equipment (Flammable Materials Storehouse)	1918
20	Administration Building, Research and Development (Flammable Materials Storehouse)	1918
21	General Instrumentation Building (Flammable Materials Storehouse)	1918
22	Precision Machine Shop	1918
30	General Purpose Warehouse (Storehouse)	1918
33	Motor Repair Shop	1933
36	General Purpose Warehouse	1918
39	Facility Engineering Maintenance Shop (Storage)	1918
40	General Purpose Warehouse	1918
41	General Purpose Warehouse	1918
45	General Purpose Warehouse	1918

BUILDINGS 100-149

Although the majority of people employed at Picatinny Arsenal have been civilians, family housing has traditionally been provided for military personnel. Several housing units which remain possess significance because of their association with the earliest periods of development at the Arsenal, their use as residences for senior arsenal personnel, and in some cases because of noteworthy architectural features.

Category II Properties

110	BOQ Military, Male (Superintendent's House)	1882
112	Family Housing, Gen.	1909
113	Family Housing, Gen.	1909
114	Family Housing, Col. (Commanding Officer's Quarters)	1884
---	Cannon Gates	1885

Category III Properties

105	Family Housing, Lt. Col., Major (Officer's Quarters)	1880
106	Family Housing, Col. (Officer's Quarters)	1899
108	Family Housing, Lt. Col., Major (Officer's Quarters)	1884/1936
115	Family Housing, Col. (Officer's Quarters/School/Firehouse)	1884
117	Family Housing, Lt. Col., Major (Stables/Transient Officer's Quarters)	1889/1937
119	Family Housing, Lt. Col., Major (Officer's Quarters/ Fill Plant/Hospital)	1887/1936
120	Civilian Personnel Building (Enlisted Men's Quarters)	1918

BUILDINGS 150-199

Following the explosion of 1926, a series of permanent buildings were erected which foreshadowed the ultimate change in emphasis at Picatinny away from production and toward administrative, research and development activities. In several cases these buildings feature Georgian-style architectural detailing.

These buildings possess limited significance because they comprise the administrative and research and development core of Picatinny Arsenal during the post 1926 explosion and WWII periods.

Category III Properties

151	Post Headquarters Building (Former)	1929
162	Applied Instruction Building (Physics/Chemical Laboratory)	1942
163	Signal Photo Laboratory (High Explosives Research Laboratory)	1930
164	Laboratory, General Purpose (Chemical/Stability Laboratory)	1930
166	Laboratory, General Purpose (Test Conditioning Chamber)	1930
167	Chemistry Laboratory (High Explosives Prep. & Test Laboratory)	1930
168	Laboratory, General Purpose (Test Conditioning Chamber/ Experimental Prop. Sur. Magazine)	1930
171	Administration, Research and Development (Foundation of Original Magazine No. 2)	1948
176	Administration, General Purpose (Plastics Laboratory)	1944
178	Physics Laboratory (Service Magazine)	1938
183	Other (Metals Test Laboratory/Steam Flow Meter House)	1945
197	Laboratory, General Purpose (Laboratory and Test Building)	1942

200 AREA

The buildings in the 200 area are among the oldest at the Arsenal. The brick storehouses built in the late 1880s and early 1890s were converted to assembly

buildings when fuze assembly was begun in the 1920s. The fuze, which controls the timing and character of an explosion, is the most complicated part of a shell. Activities within the 200 area included the manufacture of mercury fulminate, lead azide, and tetryl, the sub-assembly of the major elements of the fuze, (primers, delays, and detonators), and the final assembly of the complete fuze.

Category II Properties

#213	Ordnance Facility (Fuze Testing & Loading)	1916
#230	Ordnance Facility (Primer & Detonator Loading)	1918
#232	Ordnance Facility (Detonator Loading)	1918
#235	Ordnance Facility (Mercury Fulminate Mixing)	1918
#252	Operating (Press Loading)	1918
#256	Ordnance Facility (No. 6 Powder Magazine/Booster & Fuze Loading Bldg.)	1889
#266	Laboratory General Purpose (Original Magazine for HE "A" Pump & Change House)	1903
#276	Major Caliber Projectile Loading. (Original No. 6 Powder Magazine, Melt Loading)	1902

Category III Properties

#221	Ordnance Facility (Cast High Explosives Fill Plant)	1941
#230-G	General Storehouse (Air-Conditioning)	1944
#232-C	Air Conditioning Plant	1943
#241	Operating (Demilling & Disassembly)	1942
#241-E	Storage	1918

#252-C	Magazine (Ammonium Picrate Screening)	1920
#267	Ordnance Facility	1941
#268	Operating (Primary Explosives)	1941
#269	Operating (Artillery Primer Loading)	1941
#271	Ordnance Facility (Original Magazine for HE "B" Fuze Assembly Plant)	1905
#271-C	Ready Magazine	1921
#271-D	Ordnance Facility (Air-Compressor House)	1920
#271-H	Major Caliber Projectile Loading (Operating)	1942
#271-I	Ordnance Facility (Primer Mixture Preparing Room)	1941
#271-J	Ordnance Facility (Dry House)	1941
#271-K	Ordnance Facility (Fan House)	1941
#271-L	Ordnance Facility (Lead Azide Powder Dry House)	1941
#271-O	General Purpose Magazine	1918
#271-P	General Purpose Magazine	1918
#276-D	General Storehouse	1920
#281	Ordnance Facility (Pelleting/Office/Change House/Tool Room	1921
#295	Major Caliber Projectile Loading (Lead Azide and Primer Mixture	1941
#296	Other (Pelleting for Pyroteching Explosives)	1941

300 AREA

Those buildings in this area possessing significance relate to the development of powder production shortly after the turn of the century. The early buildings in this area were originally used to store loaded projectiles and

explosives. In addition to their association with the early production period at the arsenal, many of these buildings later housed research and development activities relating to important non-production activity at Picatinny.

Category II Properties

315	Post Engineering Maintenance (Original Storehouse for Sodium Nitrate)	1907-8
316	Metallurgy Laboratory (Foundry/Original Storehouse for Sodium Nitrate)	1907-8
318	Metallurgy Laboratory (Records Holding Office/ Original Storehouse for Sodium Nitrate)	1907
321	Ordnance Facility (Original Storehouse for Fuzed Projectile "O")	1902
322	Metallurgy Laboratory (Foundry/87mm Loading Plant/ Original Storehouse for Sodium Nitrate)	1906
323	Laboratory, General Purpose (Original Storehouse for Sodium Nitrate)	1906-8

Category III Properties

302	Facility Engineering Maintenance Shop (Site of Original Magazine for Sodium Nitrate)	1905
305	Facility Engineering Storehouse (Post Engineering Maintenance)	1880
307	Facility Engineering Maintenance Shop (Original Powder Magazine)	1880

319	Administration, General Purpose (Original Storehouse for Sodium Nitrate)	1906
324	General Storehouse (Original Storehouse for Sodium Nitrate)	1905
326	Facility Engineering Maintenance Shop (Shell Sandblasting)	1918
329	Propellant Systems Facility (Loading Plant/Original Storehouse for Sodium Nitrate)	1918
333	Human Engineering (Power House)	1902
350	Laboratory, General Purpose (Storage)	1938
351	Physics Laboratory/Engineering Administration Building (Storage)	1938
352	Physics Laboratory/General Purpose Laboratory (Storage)	1938
354	Engineering Administration Building (Engineering Research and Development/Storage)	1940
355	Administration Building Research and Development (Engineering Research and Development/Storage)	1940/1960

400 AREA

The 400 area bag loading unit was constructed after the 1926 explosion destroyed those buildings previously used for bag loading. In building 445 cotton, rayon, or silk cloth was cut, dyed, and sewn to make bags. Nitrocellulose powder for the 500 area was brought into buildings 445, 448, 452, 454, and 462 where it was loaded into hoppers and funneled into barricaded rooms. Bags were filled with weighed amounts of powder and sewn

shut. All equipment was grounded. Sewing machines in this work area were in the rooms. Blast proof walls on three sides directed any blast out the front doors and away from other rooms. Filled bags were passed through trap doors into a central hall. The bags were then tied together taped, and packed for shipping. Propellant powder was bagged as a single unit, or, to allow for adjustments in handling and firing, it could be loaded into a series of bags.

Category I Properties

Buildings #445 and #452

These bag loading buildings were constructed specifically for this purpose following the 1926 explosion. For the first time, building construction included safety features such as emergency slides, separated work stations, and barracaded areas. Building #445 was built in 1927 as a general bag loading facility. Building #452 was built in 1934 and designed specifically for the loading of igniters.

Building #454

This bag charge finishing plant was constructed in 1937 to load 105mm charges. A two-story building, each of its several finishing rooms is directly under its own storage room from which powder was passed to the first floor where it was loaded into bags. Igniters were added at the central hall, after which the bags were sewn and wrapped.

Category II Properties

#403	Woodworking, Packaging & Testing Lab (Storehouse for Sc. Nitrate)	1906
#404	Thermo Chemical Lab (Storehouse for Sc. Nitrate)	1906
#405	Laboratory-General Purpose (Chemistry Laboratory)	1920
#406	General Purpose (Nitrating Building)	1920
#448	Ordnance Facility (Howitzer & Aliquot Bag Loading)	1930
#462	Chemistry Lab (Tracer Loading Building)	1942
#477	Ordnance Facility (Non-Gaseous Projectile Loading)	1945

Category III Properties

#406-L	Dry House	1920
#424	Ordnance Facility (Combustible Cartridge Case Factory/ Nitration Building)	1904
#424-A	High Explosives Magazine (Nitro Separation)	1941
#424-L	High Explosives Magazine	1924
#424-M	Mix House	1943
#42[illegible]	Experimental Propellants Plant	1938
#42[illegible]	Dry House	1939
#42[illegible]	General Storehouse	1921
#43[illegible]	Propellant Systems Facility (Laboratory-Propulsion Systems)	1922
#43[illegible]	Ordnance Facility (Pulverizing)	1918
#43[illegible]	General Purpose Magazine	1918
#447-A	Dust Storage	1918
#447-L	Dust Storage	1930

#445-E	Other (Storage)	1930
#455	Engineering Admin. Bldg. (Cloth Storage, Dyeing, Cutting & Sewing/Original Magazine)	1930
#456	Engineer Adm. Bldg. (Field Office)	1931
#457	Ordnance Facility (Blender & Mixer)	1941

500 AREA

The 500 area contains the Arsenal's power plant and the smokeless propellant powder factory. The power plant, built in 1907 and expanded in 1956, provides much of the steam and electricity used at the Arsenal. The powder factory was established in 1907 and rebuilt following the 1926 explosion of the Lake Denmark depot. Smokeless powder was produced by nitrating cotton, processing it with alcohol and ether, and pressing it into powder grains. The size and chemical composition of the powder varied according to the caliber and type of gun it would fire. The powder plant was operated into the 1970's.

Category I Properties

Building #520

This Poaching House was built in 1943. Here, nitrocellulose was received from Building #517, and put through a series of washes and boilings before being sent to the Power Factory (Building #527).

Building #527

The Powder Factory was constructed in 1929. Here, nitrocellulose was received from Building #520 to be dehydrated and put into several other steps until the final product, grains of smokeless powder, were made at the desired length.

Building #539 & 561

The Small Arms Powder Blender (#539) and the Cannon Powder Blender (#561) were constructed in 1930 and 1931, respectively. Similar in design, these buildings performed identical functions for both large (cannon) and small grains of (small arms) smokeless powders. Because the manufacturing process for smokeless powder inevitably produced powder whose composition and explosive characteristics varied from batch to batch, a blending operation was used to obtain a homogenous mixture with more uniform properties. Powder was brought to these buildings and dropped through a series of hoppers and funnels for mixing.

Category II Properties

#511	Propellant Plant (Nitrating House)	1918
#514	Laboratory Gen. Purpose (Boiling Tub House)	1930
#519	Ordnance Facility (Ether & Alcohol Recovery House)	1908
#533	Ordnance Facility (Solvent Recovery)	1941
#534	Ordnance Facility (Solvent Recovery)	1930
#538	General Storage (Graphiting & Sorting House)	1930
#541	Propellant Plant (Water Dry House)	1943
#545	Propellant Plant (Packer & Box Testing House)	1928
#553	Flammable Material Storehouse (Ether & Alcohol & Mixed Solvent Tanks-11)	1942
#554	Propellant Plant (Rework Powder Grinding House, Pulverizing, Water Dry House)	1930
#555	Ordnance Facility (Continuous Dry House)	1930
#565	Pack House	1931

Category III Properties

#506	Electric Power Plant	1907 1956
#507	RR Engineering Shop (Locomotive House/Round House)	1929
#509	Inert Storage (Cotton Storage Building)	1930
#510	General Storehouse (Cotton Picker & Dry House)	1930
#519-A	Storage Shed (Ether & Alcohol Storage Tanks (3))	1941
#520-B	Propellant Plant (Rest House)	1922
#521	Propellant Plant (Ether Vault)	1909
#523	Ordnance Facility (Solvent Recovery)	1938
#525	Electrical Equipt. (Office & Change House)	1930
[illegible]	[illegible] Laboratory (Acid Laboratory)	1930
#535	Propellant Plant (Recovered Solvent Storage)	1910
#537	General Storage (Dry House)	1918
#542	Propellant Plant (Dry House)	1942
#542-B	Other (Change House)	1930
#550	General Storehouse	1918
#550-A	Air Raid Shelter	1941
#556	Propellant Plant (Small Arms Powder Dry House)	1930
#556-F	Propellant Plant (Fan House, Control Room)	1944
#561-A	Propellant Plant (Fireproof Shelter)	1931

600 AREA

The Arsenal test area was moved to a ridge above Picatinny Lake after an explosion and fire in 1926 destroyed the powder factory's cannon blenders. The Army decided to rebuild one of the blenders in an area then used for testing.

Already located on a lower part of the ridge was a small black powder factory. Black powder, the military's original shell filler and propellant, was produced at Picatinny for pellets used as delay elements in fuzes, for bursting charges in shrapnel filled shells, and for igniters in propellant charges.

The major test facilities are located in one part of the 600 Area. Here indoor tests are conducted on the sensitivity, brisance (shattering capacity), stability, rapidity of reaction, energy content, and type or intensity of the initial impulse of explosives. These tests are critical in developing explosives that will best meet the Army's needs.

Further along the ridge are a series of isolated ranges for test firing guns (full barrel tests and shell flight tests), testing of armor-piercing shells and fuses, and testing of anti-personnel weapons.

Category II Properties

600	Entrance Facility, Powder Blender	[illegible]
600-1	Entrance Facility, Drop Tower	[illegible]
600-2	Entrance Facility, Fragmentation	[illegible]
600-3	Entrance Facility, Fragmentation	[illegible]

Category III Properties

600-1	Entrance Facility, Lt. House	[illegible]
600-4	Entrance Facility, Environmental Testing	[illegible]
600-4 P	Entrance Facility, Test Cutting Trailer	[illegible]

#604-C	Ordnance Facility (Sectioning)	1928
#604-E	Ordnance Facility (Wind Tunnel)	1942
#604-F	Ordnance Facility (Bull Pen)	1928
#605	Ordnance Facility (Screening Building)	1924
#607-A	Ordnance Facility (Control Room)	1938
#611-B	Ordnance Facility (Gas Gun Test Tunnel)	1929
#613	Ordnance Facility (Ballistic Mortar)	1928
#617	Administration-R&D (Office)	1928
#617-F	Magazine-Fuze & Det	1928
#620	Ordnance Facility (Test Range)	1941
#620-B	Ordnance Facility (Test Range)	1921
#620-C	Ordnance Facility (Test Range)	1943
#634	Ordnance Facility (Slug Butt)	1930
#638-A	Flammable Materials Storehouse	1928

[illegible] AREA

[illegible] properties in this area relate in a general way to the [illegible] and later the research and development activities, which have taken [illegible] Picatinny Arsenal since the 1930s.

[illegible]ategory III Properties

[illegible]	[illegible]dnance Facility (Major Caliber Projectile Loading [illegible] Plant	1939
[illegible]	Chemistry Laboratory (Magazine)	1928

722	Physics Laboratory (Office & Testing Laboratory)	1920
732	Ordnance Facility (Pyrotechnic Pelleting/Receiving, Packing & Shipping)	1938
735	Ordnance Facility (Pyrotechnic Production Unit)	1943

800 AREA

The complete rounds/melting loading area of Picatinny Arsenal was constructed on the northwest shore of Picatinny Lake beginning in 1930. It replaced numerous buildings scattered around the arsenal which had been used to load shells and bombs since 1907. The new facility, designed after the 1926 explosion destroyed the older facilities, provided for a smooth flow of materials and explosives through a grouping of four major buildings. The production line loaded, assembled, and packed for shipment various calibers of complete and semi-fixed rounds, and separated loaded shells and demolition and fragmentation bombs. The casting, pellet, lob, and base-charged loading methods were each used depending on the shell being loaded.

Category II Properties

#807	Ordnance Facility (Receiving, Cleaning, Inspection)	1930
#810	Ordnance Facility (Loading & Cooling Plant)	1930/1945
#813	Ordnance Facility (Drilling & Assembly Plant)	1930/1945
#816	Ordnance Facility (Assembly)	1930
#820	Ordnance Facility (Packing & Shipping)	1930
#824	Ordnance Facility (TNT Screening)	1930

Category III Properties

#802	General Storehouse (High Explosives Recovery)	1925
#806	Other (Bombproof Shelter & Change House)	1930
#810-A	Vacuum Pump (Wash-Out Recovery)	1944
#816-B	Ordnance Facility (Magazine/Compressor House)	1941
#823	General Purpose Magazine (Ammonimum Nitrate Service)	1930

900 AREA

These buildings possess limited significance due to their association with World War I, and post-World War I-era activities at Picatinny. Initially constructed to store materials necessary for the production of explosives, they were later adapted for the storage of surplus ammunition following World War I.

Category III Properties

904	General Purpose Magazine	1918
905	" " "	1927
906	" " "	1918
907	" " "	"
908	" " "	"
909	" " "	"
911	" " "	"
912	" " "	"
914	" " "	"

915	"	"	"	"
916	"	"	"	"
917	"	"	"	"
918	"	"	"	"
919	"	"	"	"
920	"	"	"	"
921	"	"	"	"
922	"	"	"	"
923	"	"	"	"
926	"	"	"	1922
928	"	"	"	1918
929	"	"	"	"
930	"	"	"	"
931	"	"	"	"
932	"	"	"	"
933	"	"	"	"
936	"	"	"	"
937	"	"	"	"
938	"	"	"	"
939	"	"	"	"
940	"	"	"	"
941	"	"	"	"
942	"	"	"	"
943	"	"	"	"
944	"	"	"	"
945	"	"	"	"

946	"	"	"	"
948	"	"	"	"
949	"	"	"	"
950	"	"	"	"
951	"	"	"	"
952	"	"	"	"
953	"	"	"	"

1000 AREA

The significant properties in this area relate to the production of the high explosive tetryl. In observance of construction guidelines established by New Jersey State law this activity was relocated in the early 1930s from a congested area to this more isolated site on the eastern ridge of Picatinny Peak .

Category II Properties

1055	Other (Experimental Tetryl Crystallization Plant)	1931
1071	Ordnance Facility (Crystallization Building)	1942

Category III Properties

1053	Other (Office & Change House)	1931
1071-G	Ordnance Facility (Dry House)	1941
1094	General Storehouse (Screening & Pulverizing)	1942

1200 AREA

This area is made up primarily of World War II-era storage facilities. The single property which possesses limited significance gains its importance because of its role in the propellant production process.

Category III Properties

1217	General Purpose Magazine/Propellant Plant	1944

1300 AREA

This is one of the last production areas to be built at Picatinny. Those properties of significance relate to activites such as the production of mortar powder and nitroglycerine.

Category II Properties

1301	Ordnance Facility (Mortar Powder Building)	1945

Category III Properties

1352	Ordnance Facility (Blending, Nitroglycerine)	1945
1363	Ordnance Facility (Neutralizing)	1945
1363-A	Ordnance Facility (Slum House)	1945
1365	Flammable Materials Storehouse (Spent Acid House)	1945
1381	Reservoir	1904
1382	Reservoir	1906

1400 AREA

This area was established during World War II. The building related to the areas wartime production activity possesses limited significance.

Category III Properties

1418	Ordnance Facility (Storage & Shipping Building)	1942

1600 AREA

The significant buildings in this area are associated with World War II-era activity at Picatinny. Their limited significance stems from their role with research and production activities during and since World War II.

Category III Properties

1604	Processing, Pyrotechnics Assembly Plant	1942
1609	Physics Laboratory (Machine Shop)	1942
1616	Ordnance Facility (Preparation of Pyrotechnics)	1942
1619	Laboratory-General Purpose (Radiographic Laboratory)	1942

LAKE DENMARK POWDER DEPOT AREA

This area was originally part of the Navy's Lake Denmark Powder Depot. The majority of those buildings identified as significant relate to the depot's administration and storage activities since World War I. Because this area

functioned as an independent depot for many years it contains many structures whose original purpose corresponds closely with other structures built at the arsenal by the Army.

Category II Properties

3013	Boiler House, Heating Plant	1905
3250	Family Housing, General, Colonel	1890
3316	Fire Station	1903
3618	Propellant Systems Facility (Test Cell 1-E)	1953

Category III Properties

3002	Engineering Administration Building (Storage)	1934
3008	Administration, General Purpose (Engineer Administration/ General Instruction Building/Displayed Orientation)	No date
[illegible]	Ordnance Administration Building	1902/1950
[illegible]	Igloo Storage	1918
[illegible]	Physics Laboratory, General Purpose Warehouse, Engineering Administration Building	1928/1981
[illegible]	Chemistry Laboratory (Storage)	1900
[illegible]	Igloo Storage	1918
		"
		"
		"
		"
		"

3039	" "	"
3041	" "	"
3042	" "	"
3045	" "	"
3047	" "	"
3049	Flammable Materials Storehouse	1918
3050	Enlisted Men's Barracks	1934
3100	Ordnance Facility	1942
3109	Ordnance Facility (Environmental Conditioning)	1943
3119	Family Housing, Lt. Col., Major	1785
3124	Administration, Research and Development	1918
3128	Flammable Materials Storehouse	1929
3137	Flammable Materials Storehouse	1934
3140	Facilities Engineer Storehouse (Magazine)	1934
3155	General Purpose Warehouse (Magazine)	1929
3157	Pump House	1896
3159	Administration Building, Research and Development (Laboratory/Storage)	1930
3164	Igloo Storage	1918
3166	General Purpose Warehouse (Storage)	1929
3172	Igloo Storage	1918
3173	Laboratory, General Purpose (Applied Instruction Building/Carpenter's Shop)	1902
3175	Open Storage Area (Coal Bin)	1901
3176	Precision Machine Shop (Applied Instruction Building/ Ordnance Facility/Storage)	1902

3177	Electrical Equipment Facility (Applied Instruction Building/Ordnance Facility Storage)	1914
3178	Flammable Materials Storehouse (Paint Locker)	1905
3180	Igloo Storage	1918
3203	General Purpose Warehouse	1930
3208	Electrical Equipment Facility (Transmitter Building/ General Purpose Warehouse)	1929
3211	General Purpose Warehouse	1929
3221	Chapel (Blacksmith's Shop)	1911
3228	Theater, Open Mess	1932
3234	Igloo Storage	1918
3236	Flammable Materials Storehouse	1930
3239	General Storehouse (Pump House)	1905
3242	General Purpose Warehouse	1919
3252	General Storehouse (Tool House)	1918
3300	Igloo Storage	1918
3303	Igloo Storage	1918
3617	Propellant Systems Facility (Control House)	1953

NOTES

1. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).

2. National Park Service, Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings, 1983 (Washington, D.C.: Preservation Assistance Division, National Park Service, 1983).

3. National Park Service, "Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines, "Federal Register, Part IV, 28 September 1983, pp. 44730-44734.

4. National Park Service, Secretary of the Interior's Standards.

5. National Park Service, "Archeology and Historic Preservation."

6. National Park Service, Secretary of the Interior's Standards.

7. National Park Service, "Archeology and Historic Preservation."

BIBLIOGRAPHY

A) BOOKS

Bergaust, Erik. Rockets of the Armed Forces. New York: G.P. Putnam's Sons, 1966.

Campbell, Levin H., Jr., LT. GEN. The Industry-Ordnance Team. New York: Whittlesey Publishers, c.. 1946.

Davis, Tenney L. Ph.D. The Chemistry of Powder and Explosives. New York: John Wiley and Sons, Inc., 1941.

Fine, Lenore; and Remington, Jesse A. The Corps of Engineers: Construction in the United States, United States Army in World War II, The Technical Services. Washington, D.C.: Government Printing Office, 1971.

Glackin, James. Elements of Explosives Production. Boulder, Colo.: Palladin Press, 1976.

Green, Constance McLaughlin; Thomson, Harry C.; and Roots, Peter C. The Ordnance Department: Planning Munitions for War, United States Army in World War II, The Technical Services. Washington, D.C.: Office of the Chief of Military History, U.S. Dept. of the Army, 1955.

Guttman, Oscar. The Manufacture of Explosives. New York: MacMillan & Co., 1895.

Lissak, Ormond M. Ordnance and Gunnery. New York: John Wiley & Sons, Inc., 1915.

McFarland, Earl LT. COL. Textbook of Ordnance and Gunnery. New York: John Wiley & Sons, Inc., 1929.

Marshall, Arthur. Explosives. London: J.A. Churchill, 1917.

Muhlenberg, Henry, "History of Arsenals: Augusta, Benicia, Frankford, New York, Picatinny". 1912 (Typewritten).

Ohart, Theodore C. MAJ. ORD. DEPT. U.S.A. Elements of Ammunition. New York: John Wiley & Sons, Inc., 1946.

Ordnance School, Picatinny Arsenal. Ammunition, Powder and Explosives Course II, 4 Vols. Dover, N.J.: Picatinny Arsenal, 1940.

Platt, Charles D. Dover Dates 1722-1922: A Bicentennial History of Dover, N.J. Dover, N.J., 1976.

U.S. Department of Navy. Building the Navy's Bases in World War II, History of the Bureau of Yards & Docks and the Civil Engineering Corps., Vol. I. Washington, D.C.: Government Printing Office, 1947.

VanGelder, Arthur Pine, and Schlatter, Hugo. History of the Explosive Industry in America. New York: Columbia University Press, 1927.

War Plans Division, Plant Engineering Department. The History of Picatinny Arsenal, Vol. 1. Picatinny Arsenal, N.J., 1931; Reprint Ed., Facilities Engineering Division, 1976.

B) ARTICLES IN JOURNALS AND NEWSPAPERS

Dover Era, (Dover, NJ), 1885.

Hale, G.C. Dr. "Research Activities at Picatinny Arsenal". Army Odnance, Vol. VII, No. 37, (July-August 1926): pp. 13-17.

Hare, Ray M. CAPT. Q.M.C. "Building Safety into an Explosive". The Quartermaster Review. (Nov.-Dec. 1930): pp. 46-50.

Harris, John P. CAPT.ORD. DEPT. U.S.A. "Loading Ammunition at Picatinny Arsenal". Army Ordnance Vol. VII, No. 37 (July-August 1926): pp. 40-48.

Miles, F.H., Jr. "Picatinny Arsenal". Army Ordnance, Vol. II, (Jan.-Feb. 1922): pp. 234-236.

Miles, F.H., Jr. "The Picatinny Arsenal Powder Factory". Army Ordnance, Vol. VII, No. 37 (July-August 1926): pp. 9-12.

"Picatinny Provides a Life for Morris Co. Towns". Star Ledger, 24 April 1979.

The Jerseyman (Morristown, N.J.) 1880-1926.

C) PHAMPHLETS AND REPORTS

Harris, J.P. COL. ORD. CORPS. U.S.A. Picatinny Arsenal. Dover, N.J.: Picatinny Arsenal, 1953.

Klanderman, R.R. COL. ORD. CORPS. Commander. Profile Picatinny Arsenal, Dover, N.J.: Picatinny Arsenal, March 1961.

Larned, W.E. COL. Picatinny Arsenal 1879-1943, Development Plant for Bombs, Explosives, Pyrotechnics, and Artillery Ammunition. Dover, N.J.: Picatinny Arsenal, Oct. 1943.

Meyers, M. Ph.D. Chief, Historical Office. "History of the U.S. Army Armament Research and Development Command". Dover, N.J.: Feb. 1981. (Mimeographed).

Nadel, M. "Powder Factory". Dover, N.J.: Picatinny Arsenal, (Mimeographed).

Ordnance Corps, U.S.A. Plant Engineering and Maintainence Office. Dover, N.J.: Picatinny Arsenal, 1958.

Picatinny Arsenal 1880-1944, Vol 13, No. 3, pp. 37-48: Description of American Arsenal. New York: Houghton Line, 1944.

Picatinny Arsenal Personnel. The Ordnance Bomb, Yearbook For Picatinny Arsenal. Dover, N.J.: Picatinny Arsenal, 1937.

Research & Engineering. Dover, N.J.: Picatinny Arsenal, c. 1961 (Mimeographed).

U.S. Army ARRADCOM at a Glance.

U.S. Picatinny Arsenal. Report of the Technical Division, January 1948.

D) GOVERNMENT DOCUMENTS

The Survey of Federal Archives, Division of Professional & Service Projects.
Works Projects Administration, (The National Archives, Cooperation Sponsor). Inventory of Federal Archives in the States. Series IV, The Dept. of War, No. 29 New Jersey. Newark N.J.: The Historical Records Survey Project, 1940.

U.S. Congress. House. Letter from the Acting Secretary of War Transmitting Proceedings of the Joint Board Composed of Officers of the Army and Navy to Survey Ammunition Storage Conditions, Pursuant to the Act Approved December 27, 1927. (Public Law No. 2, 70th Congress). H Doc. 199, 70th Cong., 1928.

U.S. Department of Navy. Annual Report of the Secretary of the Navy, for the Year 1890. Washington, D.C.: Government Printing Office, 1890.

U.S. Department of Navy. Annual Report of the Secretary of the Navy, for the Year 1891. Washington, D.C.: Government Printing Office, 1891.

U.S. Department of Navy. Annual Report of the Secretary of the Navy, for the Year 1892. Washington, D.C.: Government Printing Office, 1892.

U.S. Department of Navy. Annual Reports of the Navy Department, for the Fiscal Year 1926 (including operations to Nov. 15, 1926). Washington, D.C.: Government Printing Office, 1927.

U.S. Department of Navy. Annual Reports of the Navy Department, for the Fiscal Year 1927 (including operations to Nov. 15, 1927). Washington, D.C.: Government Printing Office, 1928.

U.S. Department of Navy. Annual Reports of the Navy Department, for the Fiscal Year 1928 (including operations to Nov. 15, 1928). Washington, D.C.: Government Printing Office, 1929.

U.S. Ordnance Department. Ordnance Reports, Vol 3. 1860-1889.

E) PHOTOGRAPHS

Picatinny Arsenal. Explosion of 1926: Record of Building Damage, Illustrated. Picatinny Arsenal Library.

Picatinny Arsenal, Museum Archives. Still Photography Collection.

Washington, D.C. National Archives. Still Photography Division. Record Group 71. Boxes 212 & 213; RG 71-LD. "Lake Denmark (Dover) N.J. Naval Depot", 1926-1940.

END

2-87

DTIC